

REMARKS

Reconsideration of this application, as amended, is respectfully requested.

Claims 1 and 4-11 are pending. Claims 1 and 4-11 stand rejected.

Claims 1, 4, and 5 have been amended. Claims 6 – 11 have been cancelled. Claims 12 – 15 have been added. Support for the amendments is found in the specification, the drawings, and in the claims as originally filed. Applicants submit that the amendments do not add new matter.

Rejections Under 35 U.S.C. § 103(a)

Claims 1 and 4-11 stand rejected under 35 U.S.C. § 103 as being unpatentable over U.S. Patent No. 5,885,755 of Nakagawa (“Nakagawa”) in view of European Patent No. 0110558 of Fukuda (“Fukuda”) and U.S. Patent No. 6,248,171 of Gurer (“Gurer”).

The Examiner has rejected claims 1 and 4-11 under 35 U.S.C. § 103 as being unpatentable over Nakagawa in view of Fukuda and Gurer. The Examiner has stated that

Nakagawa teaches in Figures 2a-2g and column 3, line 55 to column 4, line 52, a developing process. A pattern-irradiated photoresist layer, on a spin chuck, has a washing liquid applied as a pretreatment for development. A film is formed upon which the developer is applied. After the developer has completely replaced the film, more developer is applied followed by a rinse of pure water.

Nakagawa does not teach a multi-port nozzle. This is taught by Fukuda and Gurer.

Fukuda teaches a process of developing whereby a rinse solution is applied after development. It is taught that the substrate can be rotated during development. Figure 2 depicts the nozzle as having several ports labeled as 11-14. See page 4, line 29 to page 5, line 27. It is taught that the process leads to uniform distribution of the developer solution and the use of a smaller amount of solution. Fukuda does not specifically teach using the nozzle to apply both solutions although it is implied. Gurer specifically teaches a process of development with the application of both developer and rinsing solution. It is taught that the nozzle which has a plurality of outlets is used to dispense both the developer and rinsing solution (see column 9, lines 37-63).

Therefore, it would have been obvious to one of ordinary skill in the art to have used a multi-port nozzle in a developing process which involves the application of rinse and developer because Fukuda teaches that such a nozzle leads to uniform distribution of material on the substrate and Gurer teaches that it is conventional in the art to dispense both the developer and the rinsing solution from the nozzle.

Applicant argues that Fukuda does not teach dispensing both liquids from the nozzle. Gurer has been added to the rejection for this specific teaching.

(p. 2-3, Office Action 7/1/03)

Applicants respectfully submit, however, that amended claim 1 is not rendered obvious under 35 U.S.C. § 103 by Nakagawa in view of Fukuda and Gurer. Amended claim 1 includes the following limitations.

A method comprising:
dispensing a first quantity of a substantially inert material onto a wafer surface to form a layer of substantially inert material
dispensing a first charge of developer fluid onto the surface of the wafer, such that a momentum imparted by the first charge of developer fluid to a micro-structure on the wafer surface is reduced by the layer of substantially inert material;
allowing at least a portion of developer fluid of the first charge of developer fluid to puddle on the wafer surface for a predetermined dwell time to permit substantial completion of a developing chemical reaction to occur, a non-uniformity of the developing chemical reaction reduced by a diffusion of the puddling developer fluid through the inert material;
dispensing a second charge of developer fluid onto the surface of the wafer; and
dispensing second quantity of substantially inert material onto the wafer surface.

(Amended claim 1) (emphasis added)

Applicants have amended the claims to delete the limitations related to a multi-port nozzle. Applicants, therefore, would like to direct the following remarks to distinguishing the claimed invention from Nakagawa and the combination of Nakagawa and Shibata (EP 0 794 463), previously cited.

The process of Nakagawa includes a pure water layer on the photoresist followed by dispensing developer in a mist form for several seconds. This allows the pure water to be gradually displaced with developer. This is done to overcome the hydrophobic property of the photoresist on the wafer surface, which results in the developer being repelled from the photoresist (Nakagawa, col. 1, lines 56 – 64). Once the pure water has been replaced with the developer, additional developer is dispensed, again in mist form, for several more seconds. It is only at this point, when the second dispensing of developer mist has occurred that the developing treatment is carried out. Subsequently, the wafer is rinsed with a washing liquid. (Nakagawa, col. 3, line 55 – col. 4, line 52)

The claimed present invention dispenses an inert material (e.g., deionized water) followed by dispensing a first and second charge of developer, and subsequently dispenses additional inert material. In the process as claimed, the first quantity of inert material is dispensed upon the wafer surface for a different reason than Nakagawa, and the first and second charges of developer fluid are dispensed upon the wafer surface in a different manner and for a different reason than Nakagawa.

In the process of the claimed invention, the first quantity of inert material is dispensed upon the surface of the wafer to reduce the impact on the wafer of the developer fluid and to provide a mechanism for a more uniform chemical reaction. When the first charge of developer fluid is dispensed upon the surface of the wafer, momentum imparted by the first charge of developer fluid to a micro-structure on the wafer surface is reduced by the layer of inert material. This doesn't happen in Nakagawa because the initial developer is dispensed in mist form in contrast to the claimed invention.

In the process of the claimed invention, the first charge of developer is allowed to puddle on the wafer surface for a predetermined dwell time to permit substantial completion of a developing chemical reaction to occur. In contrast, in Nakagawa, the developing treatment does not occur when the initial developer is dispensed in mist form. In Nakagawa, it is only after the

second dispensing of developer mist has occurred that the developing treatment is carried out (Nakagawa, col. 4, lines 25 – 34).

Moreover, Nakagawa does not disclose the reduction of non-uniformity of the developing chemical reaction due to diffusion of the developing fluid through the inert material. This is because in Nakagawa the layer of pure water has been gradually scattered off prior to the complete dispensing of the first developer mist and is completely scattered off prior to initiating dispensing of the second developer mist.

For these reasons, applicants respectfully submit that claim 1, as amended, is not rendered obvious by Nakagawa, alone or in combination with Fukuda and Gurer.

As previously discussed, Nakagawa does not disclose puddling, but as may be discerned from the above comparison, and as the discussion below makes more evident, the combination of Nakagawa with a reference disclosing puddling will not render obvious the claimed invention.

Shibata discloses a process including puddling developer followed by the application of additional developer. However, it would not be practical, or even possible, to combine Shibata with Nakagawa for the following reasons. The puddling, and the dissolution of the resist in Shibata occurs after dispensing the initial developer. In contrast, in Nakagawa the developing treatment occurs only after the second dispensing of developer mist has occurred as discussed above. Nakagawa cannot puddle the initial developer because the initial developer is dispensed as a mist. Moreover, even if Nakagawa could puddle the initial developer, it would not then be possible, in Nakagawa, to delay the developing treatment until after the second dispensing of developer mist has occurred as disclosed in Nakagawa. Puddling the initial developer cannot be incorporated into Nakagawa, which discloses dispensing the initial developer in mist form. Likewise, the dissolution of the resist upon dispensing the initial developer, as disclosed in Shibata, cannot be incorporated into Nakagawa.

Even if such a combination were possible, the combination would still lack the limitations of the claimed invention as discussed above. That is, if the initial developer in Nakagawa was puddled and developing treatment was delayed until dispensing of the second developer, it would still not disclose the claimed invention, in which substantial completion of the developing chemical reaction occurs during puddling of the first charge of dispensing fluid.

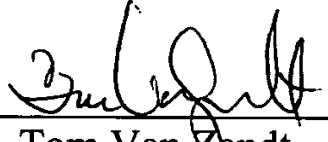
Applicants respectfully submit that amended claim 1 has been distinguished over Nakagawa, alone or in combination, with Fukuda and Gurer. Moreover, applicants respectfully submit that amended claim 1 has been distinguished over Nakagawa in combination with Shibata, or any reference that adds puddling to Nakagawa.

Given that new claims 4, 5, and 12 – 15 depend, directly or indirectly, from claim 1, applicants submit that claims 4, 5, and 12 – 15 are likewise distinguished over Nakagawa, alone or in combination, with Fukuda and Gurer, and are also distinguished over Nakagawa in combination with Shibata.

It is respectfully submitted that in view of the amendments and arguments set forth herein, the applicable rejections and objections have been overcome. If there are any additional charges, please charge Deposit Account No. 02-2666 for any fee deficiency that may be due.

Respectfully submitted,

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